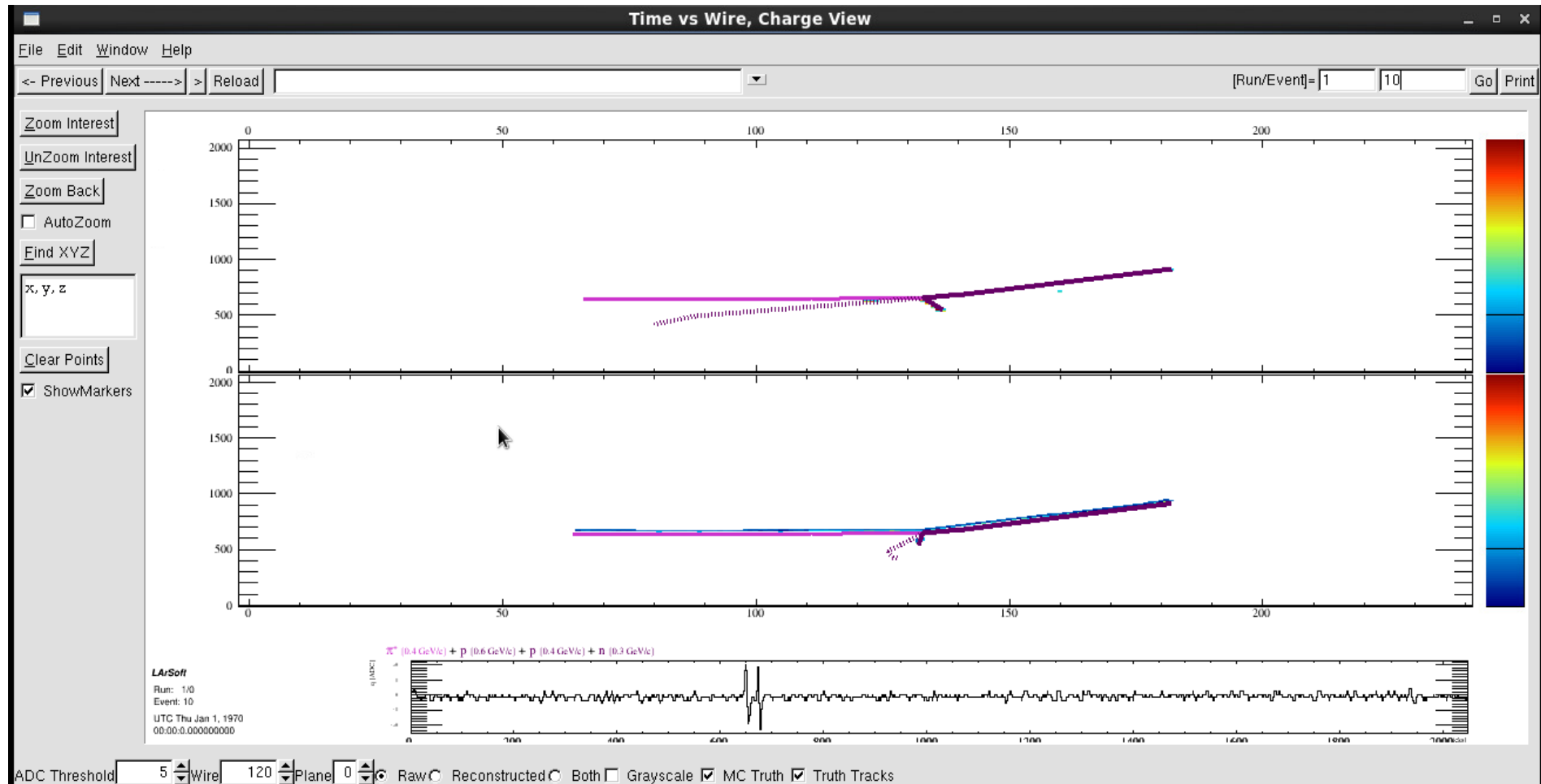


Pion Absorption Preliminary Studies

LSU



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Pion Absorption

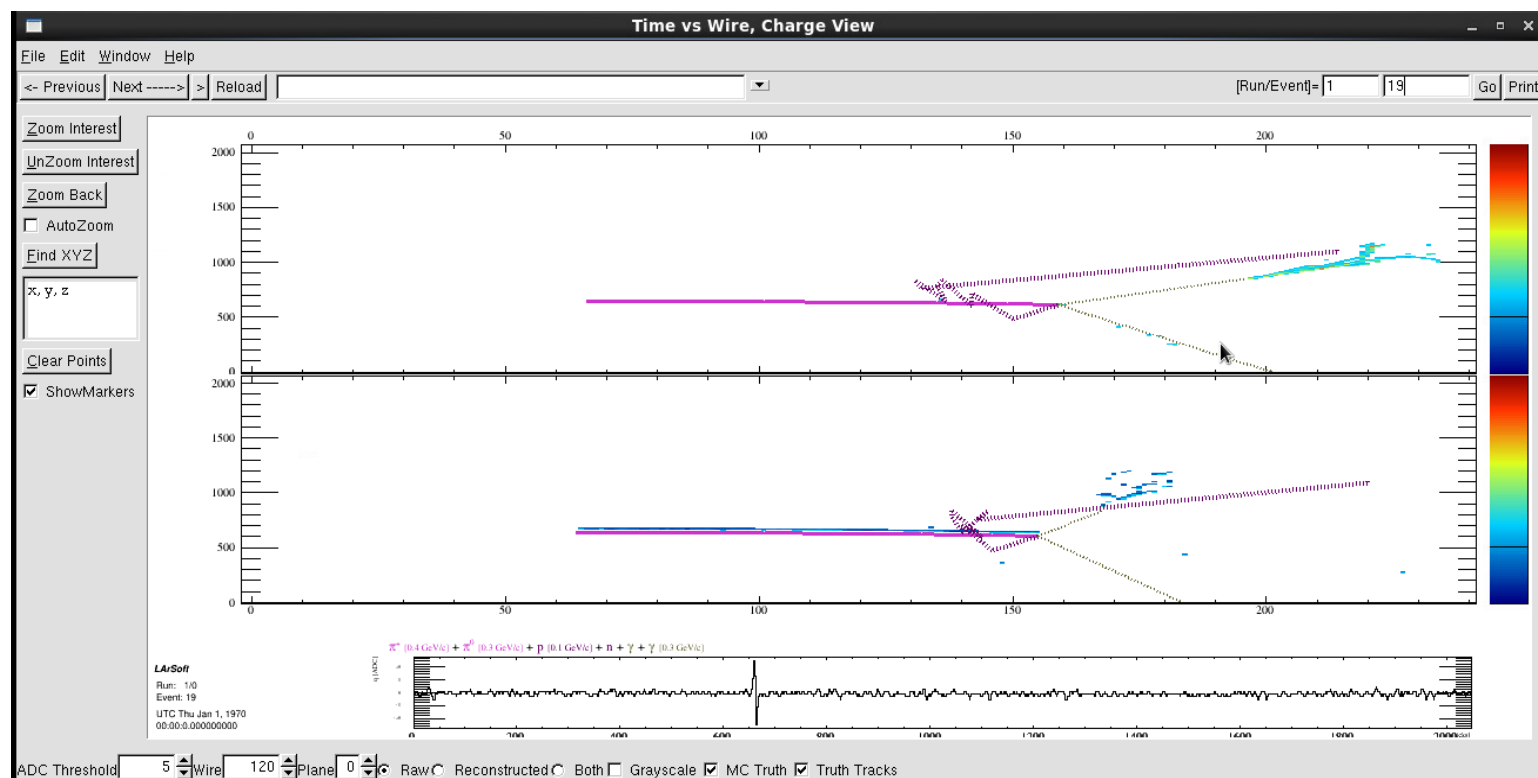
- Pion absorption is defined as a pion interaction with a nucleus that has one pion in the initial state and no pions in the final state
- Intra-nuclear interactions dominated by delta resonance from delta mass to ~ 1 GeV
- Protons and neutrons most common final state

Pion Absorption

- Expect more protons for π^+ and more neutrons for π^-
- Pion absorption products for kinetic energy > 1 GeV are also usually nucleons although the delta resonance contributes less to interactions at higher energies
- Rare decay of delta resonance that produces a photon

Signals to be Excluded

- Pair of photons produced from decay of π^0
- Muon produced by decay of entering or exiting pion



Importance to Neutrino Experiments

- Knowledge of pion absorption cross sections can help constrain the influence of nuclear effects on the final state of neutrino-nucleus interactions
 - Pions produced in neutrino-nucleon interactions can be absorbed in a parent nucleus

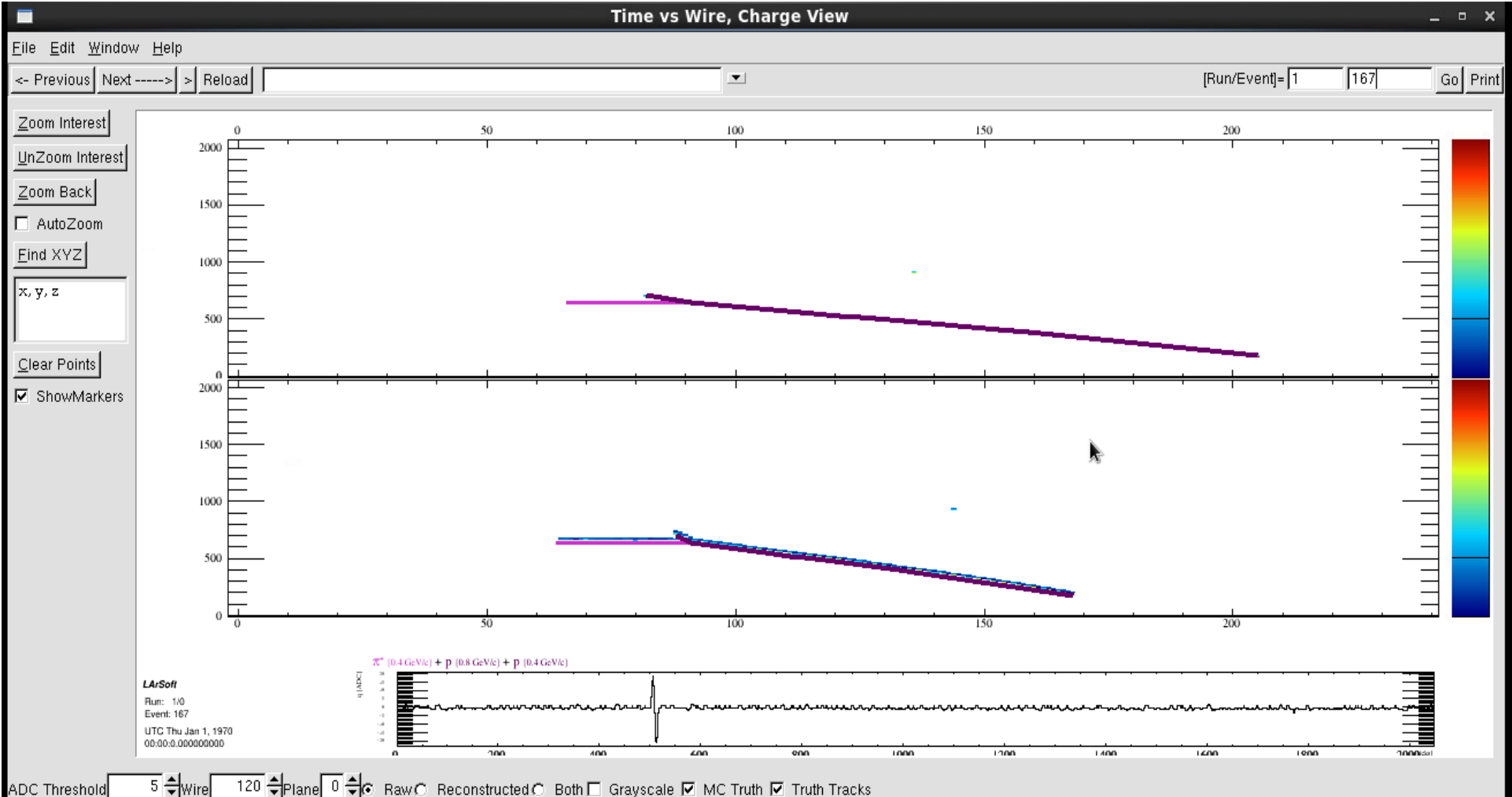
Strategies for Identification

- Exclude events with muons
- Barring interactions of final-state protons inside the nucleus, all events should have at least one proton
- Exclude events with photons in order to remove π^0 decays
- Neutrons could provide interesting information, but I expect them to be difficult to reconstruct

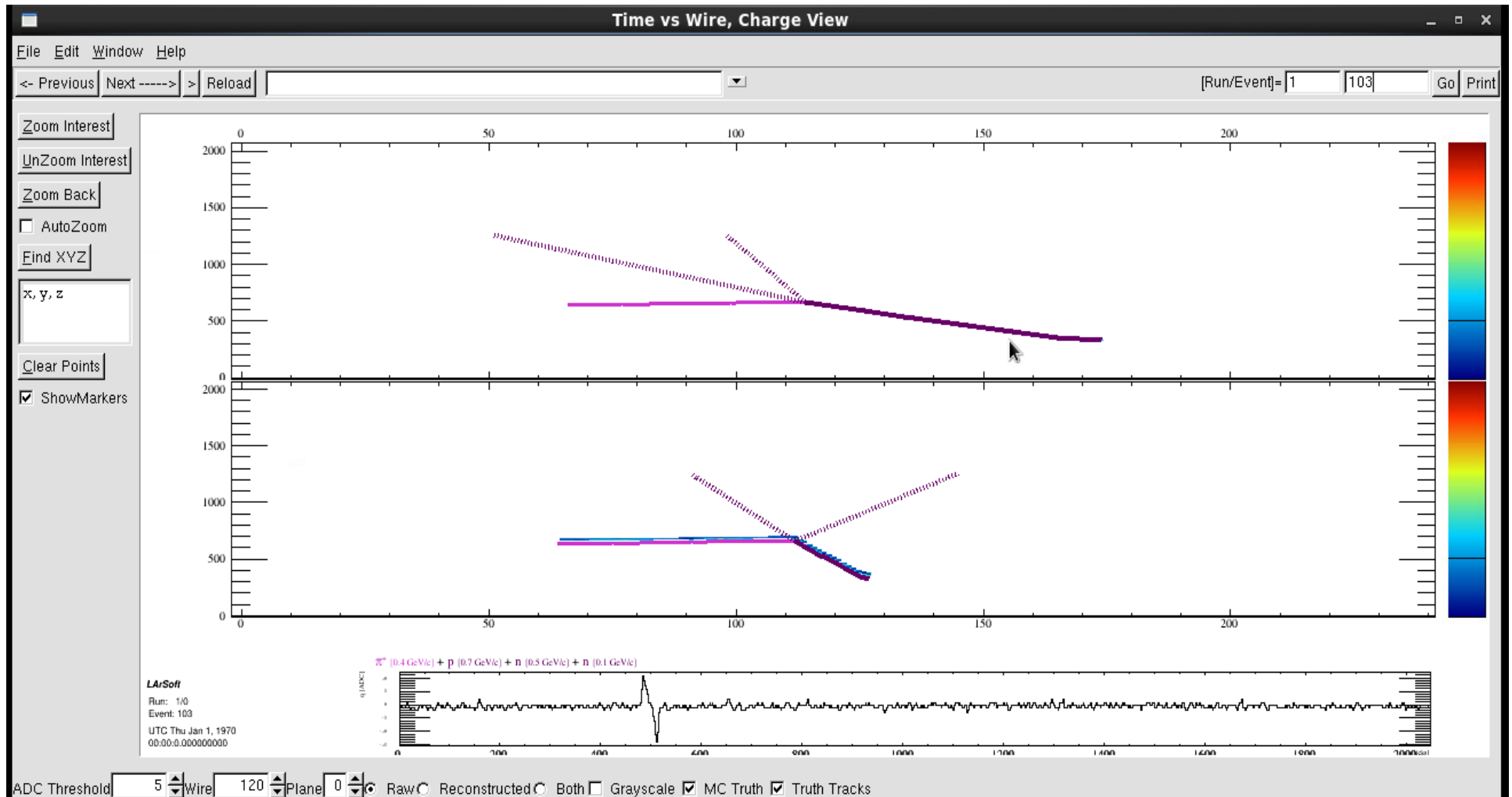
Tools Needed for Pion Absorption Measurement

- Initial state information
 - Momentum
 - PID
 - TOF versus momentum feature branch
- PID in the TPC after a vertex
 - dE/dx
 - Shower reconstruction
 - MuRS to distinguish between muons and pions

Large Pion Monte Carlo Sample



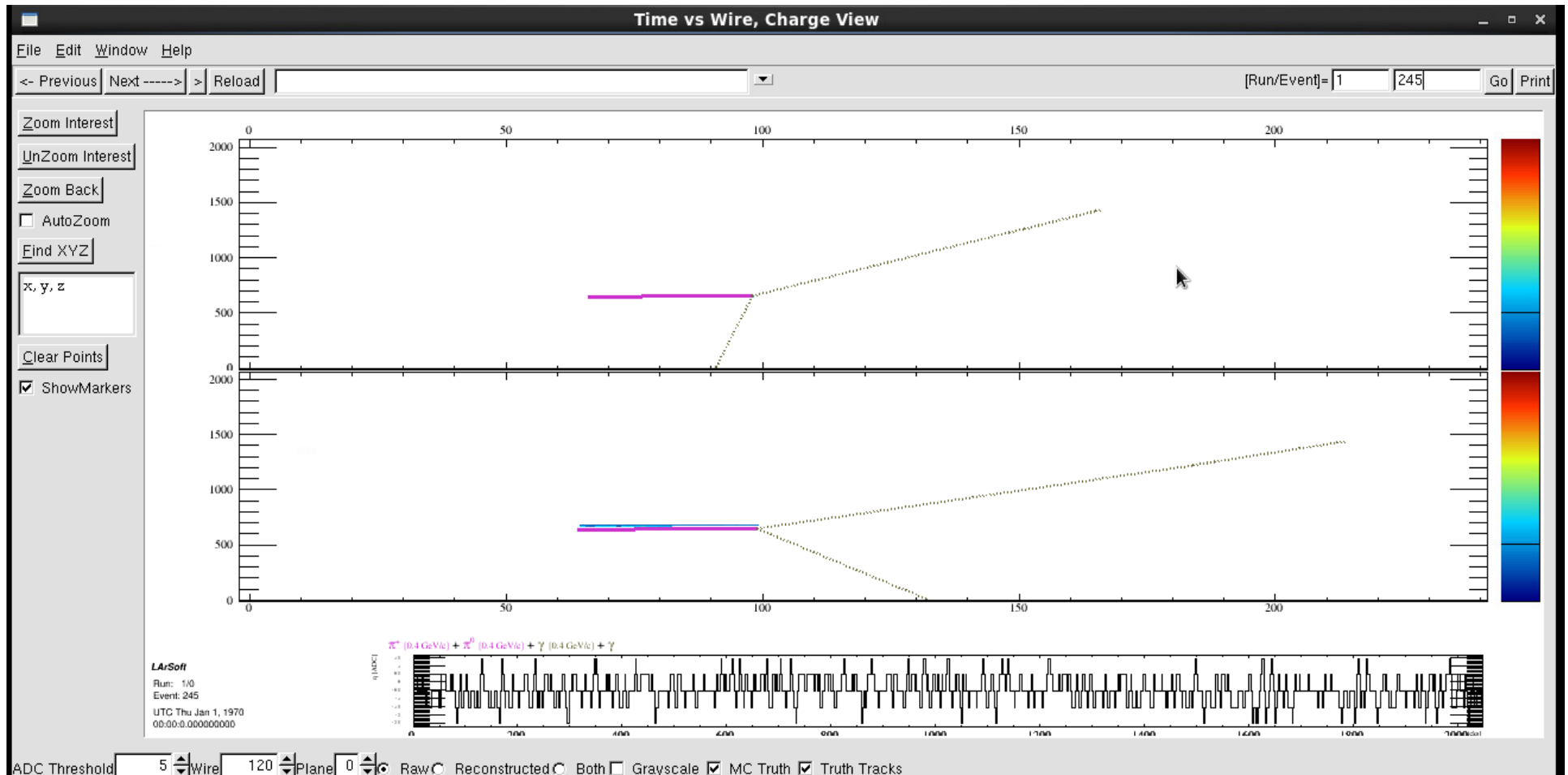
Large Pion Monte Carlo Sample



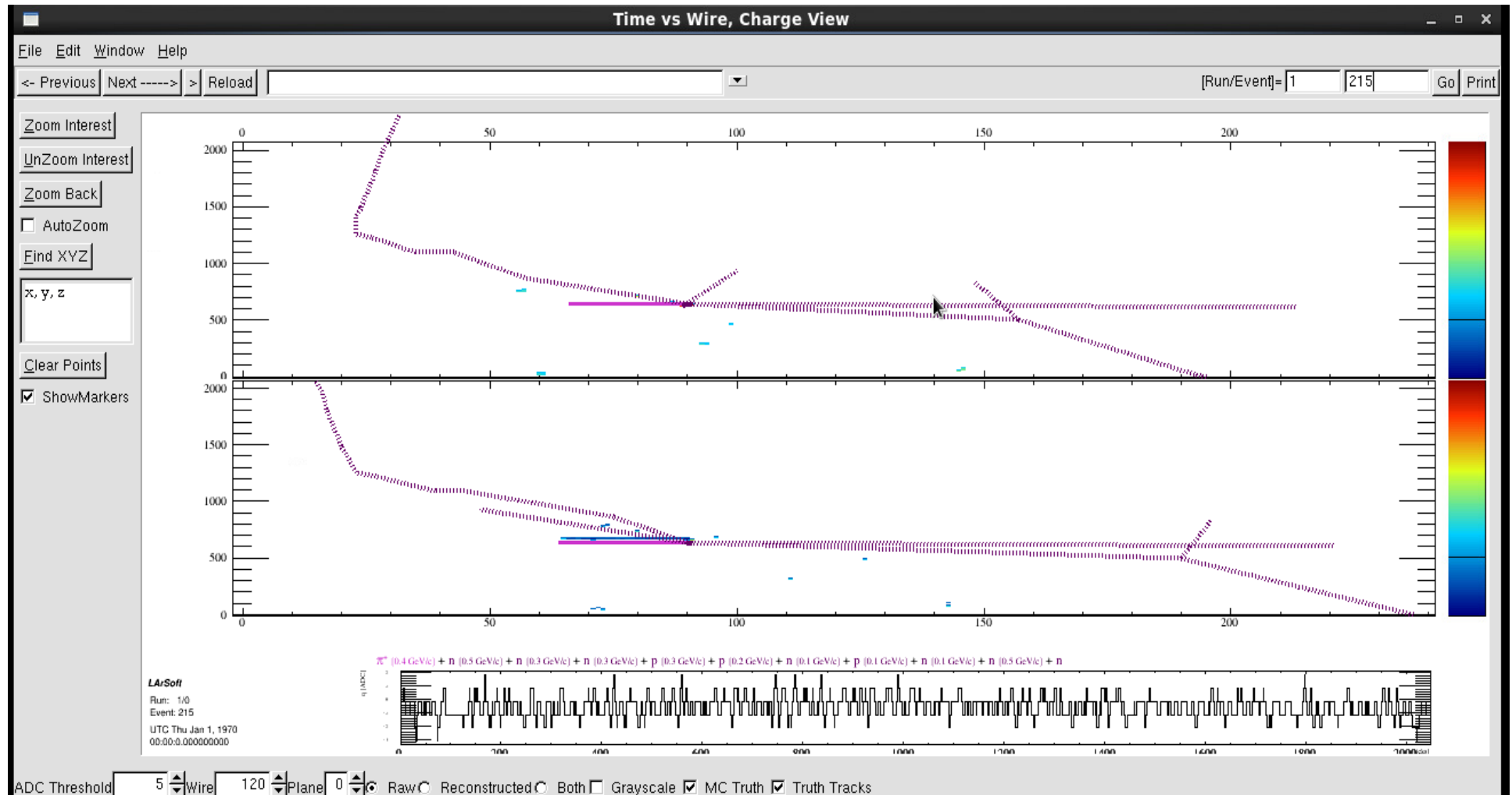
Future Work

- Measure pion absorption cross section on argon as a function of initial pion momentum
 - Get large data sample to test TOF versus momentum plot
 - Use MC analysis to compare performance of tracking modules
 - Investigate status of LArIAT calorimetry
 - Continue to study MC vertices in TPC

Backup: Harder Reconstruction Problems



Backup: Harder Reconstruction Problems



Backup: Harder Reconstruction Problems

